

Z00519 – PHYSIOLOGY

FINAL TERM MOST IMPORTANT QUESTIONS

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Q-1 Define ornithine Urea cycle.

All vertebrates except most teleost fishes, synthesize urea primarily in the liver via the ornithine-urea cycle. In this cycle, 2 ammonia and 1 CO₂ molecule are added to ornithine to form arginine. Arginine is cleaved by the enzyme arginase, to remove a molecule of urea and regenerate ornithine.

Q-2 What is diastole?

Diastole is the phase of the cardiac cycle during which the heart's chambers, particularly the ventricles (lower chambers), relax and fill with blood. This phase occurs between heartbeats, specifically when the heart is not contracting to pump blood. During diastole, the ventricles expand, creating lower pressure within them. This lower pressure allows blood to flow from the atria (upper chambers) into the ventricles. The diastolic phase is essential for ensuring that the heart is adequately filled with blood before the subsequent contraction (systole) pushes the blood out to the body's circulatory system.

Q-3 How Acetylcholine works as slow neurotransmitter?

Acetylcholine acts as a slow neurotransmitter by binding to muscarinic receptors, which are G-protein coupled receptors. This triggers a series of intracellular signaling events that result in slower and longer-lasting changes in neuronal excitability, synaptic plasticity, and other cellular responses.

Q-4 What are crypts of Lieberkuhn?

The epithelium of the mammalian small intestine secretes intestinal juice which is a mixture of two fluids secreted by Brunner's glands and crypts of Lieberkuhn (mucosal glands). Crypts of Lieberkuhn (mucosal glands) in the intestinal folds produce a thinner, enzyme-rich alkaline fluid. This fluid mixes with duodenal secretions.

Q-5 Write types of blood vessels.

Three types of blood vessels carry blood during circulation:

- **Arteries** which carry blood away from the heart to organs and tissues.
- **Veins** which return blood to the heart.
- **Capillaries** which have thin walls formed of only a single layer of endothelial cells and permit exchange of materials between blood and tissues.

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Q-6 Define motility and its significance.

Motility is crucial for organisms and cells to move, function, and survive. It's essential for processes like reproduction, digestion, circulation, respiration, and immune responses. Motility allows cells to reach their destinations, helps organisms find food, and enables bodily systems to work properly.

Q-7 What are types of Alimentary Canal?

Types of Alimentary Systems

There are two basic plans of alimentary systems observed in animals:

1. Sac-like Gastrovascular Cavity
2. Tubular Alimentary Canal or Gut

1. Sac-like Gastrovascular Cavity

The sac-like gastrovascular cavity is characteristic feature of Cnidarians. This cavity has only one opening, the mouth that serves for both ingestion as well as egestion.

2. Tubular Alimentary Canal or Gut:

The complex bilateral animals have a hollow, tubular cavity which is open at both ends with two openings: mouth for ingestion and anus for egestion. Such a tube is called a complete digestive tract or alimentary canal. Alimentary Canal allows unidirectional flow of food materials, increasing the efficiency of digestive and absorptive processes.

Q-8 Write names of parts of lungs.

The lungs are complex organs responsible for the exchange of oxygen and carbon dioxide in the respiratory system. They consist of several important parts:

1. **Bronchi:** The bronchi are the main airways that carry air from the trachea (windpipe) into the lungs. The trachea branches into two bronchi, one leading to each lung.
2. **Bronchioles:** Bronchioles are smaller branches that further divide from the bronchi. They continue to divide into even smaller bronchioles, ultimately leading to tiny air sacs called alveoli.
3. **Alveoli:** Alveoli are tiny, grape-like structures at the end of the bronchioles. These sacs are where the exchange of oxygen and carbon dioxide between the air and blood takes place. The walls of the alveoli are very thin, allowing for efficient gas exchange.
4. **Lobes:** Each lung is divided into lobes. The right lung has three lobes (upper, middle, and lower), while the left lung has two lobes (upper and lower). These lobes house various segments that help maintain the lung's structure and function.

5. **Pleura:** The pleura are thin, double-layered membranes that surround each lung and line the inside of the chest cavity. The space between these layers, known as the pleural cavity, contains a small amount of fluid that helps reduce friction as the lungs expand and contract during breathing.

6. **Diaphragm:** The diaphragm is a dome-shaped muscle located below the lungs. It plays a crucial role in breathing by contracting and relaxing. When the diaphragm contracts, it moves downward, increasing the volume of the chest cavity and causing air to enter the lungs. When it relaxes, the chest cavity decreases in volume, causing air to be expelled from the lungs.

7. **Trachea:** The trachea, commonly known as the windpipe, is the main airway that connects the mouth and nose to the bronchi. It allows air to pass between the lungs and the external environment.

8. **Hilum:** The hilum is the central area on the lung's medial surface where blood vessels, bronchi, and other structures enter and exit the lung. It's like a gateway for various connections between the lungs and the rest of the body.

Q-9 What is tubular reabsorption?

Approximately 99% of the water and most of the useful substances are selectively reabsorbed from the ultrafiltrate in the tubular part of the nephron into the blood in surrounding peritubular capillaries. The major reabsorbed molecules include glucose, amino acids, vitamins and inorganic salts. Due to reabsorption, the filtrate is converted into urine that has only left over nitrogenous and other waste substances when it leaves the tubule.

Q-10 Explain types of blood vessels.

Blood vessels are tubular structures that transport blood throughout the body, facilitating the circulation of oxygen, nutrients, hormones, and waste products. There are three main types of blood vessels: arteries, veins, and capillaries. Each type has distinct characteristics and functions within the circulatory system.

1. Arteries:

Arteries are blood vessels that carry oxygen-rich blood away from the heart to various tissues and organs. They have thick and muscular walls that allow them to withstand the high pressure generated by the heart's contractions. Arteries often branch into smaller vessels known as arterioles, which further distribute blood to specific regions.

2. Veins:

Veins are blood vessels that carry oxygen-depleted blood from the tissues back to the heart. Unlike arteries, veins have thinner walls and less muscle tissue. They contain valves that prevent the backward flow of blood and assist in directing blood towards the heart. Blood in veins is under lower pressure than in arteries. Smaller veins are called venules, and they eventually merge to form larger veins that return blood to the heart.

3. Capillaries:

Capillaries are the smallest and thinnest blood vessels in the body. They connect arteries to veins and are responsible for the exchange of gases, nutrients, and waste products between the blood and surrounding tissues. Capillaries have very thin walls, consisting of just a single layer of endothelial cells. This thinness allows for efficient diffusion of substances between the blood and tissue cells. Capillary beds are intricate networks found throughout the body.

Q-11 What is feedback system? Name its types.

Many biological processes have the ability of self-regulation by a mechanism which is called feedback mechanism. The basic principle of feedback in living systems is that the output or product of a process itself regulates the process.

Significance:

The feedback regulatory processes maintain homeostasis in the cells and the body of multicellular organism as a whole.

Mechanism:

The feedback controls respond to the sensory information about a particular variable e.g., temperature, salinity or pH that requires regulation. This regulation requires continuous sampling of controlled variables and respective corrective actions. Types of feedback systems: Two types of regulatory feedback systems are present:

1. Negative feedback systems
2. Positive feedback systems

Q-12 What is appendix?

The appendix is a small, pouch-like organ found at the junction of the small and large intestines in the lower right abdomen. Though once thought to be vestigial, recent research hints at its role in immune and gut health. It might serve as a reservoir for beneficial gut bacteria, aiding recovery from digestive illnesses. Despite potential functions, appendicitis, the inflammation of the appendix, is common and dangerous. Symptoms include abdominal pain, nausea, and vomiting. Surgical removal, or appendectomy, is often necessary to prevent complications such as rupture. The appendix's precise function remains debated, but its removal doesn't significantly impact a person's health.

Q-13 What is acclimatization? What are its effects?

Acclimatization: Acclimatization is a physiological, biochemical, or anatomic change within an individual animal that results from the animal's chronic exposure to new, naturally occurring environmental conditions.

Effects:

- The lung ventilation rate will increase initially to acquire adequate oxygen.

- However, within few days, lung ventilation will begin to drop back towards normal rates as the other physiological mechanisms that facilitate gas exchange at high altitude begin to operate.
- This individual animal is said to have acclimatized to the new high-altitude conditions.

Q-14 Write a note on pH regulation.

Importance of pH Regulation 283 Within the human body, blood must be maintained within the narrow alkaline pH range of 7.35 to 7.45. Outside that range, pH becomes incompatible with life as proteins are denatured and enzymes lose their ability to function. Role of Kidneys in pH Regulation Kidneys play important role in maintaining pH by two ways: 1 Bicarbonate buffering system 2 Removal of fixed acids and H^+

Q-15 Write a note on Lipase enzyme.

Lipases:

Lipases are lipid and fat digesting enzymes, secreted in the pancreatic juice and intestinal epithelium. They act on emulsified fat droplets and hydrolyze fat molecules into monoglycerides and diglycerides and finally into free fatty acids and glycerol. Emulsification by bile salts is necessary for lipases to hydrolyze lipids. If there are insufficient bile salts, fats in food are not emulsified and fat digestion by the lipases remains incomplete.

Q-16 Write a note on Action Potential.

ACTION POTENTIALS

Action potentials are the type of signals that neurons use to send information over long distances. Definition: Action potentials are large but brief changes in V_m that are propagated along axons. These changes propagate without decrement i.e. once an AP is initiated in a neuron, the signal travels along the cell membrane, producing the same amount of change in V_m at every point. Importance of action potentials:

- APs in the nervous system are responsible for every sensation, every memory, every thought— indeed every impulse to act in the environment.
- The action potentials carry information over long distances in nerve and muscle tissues.
- They also control:
 - o effector responses
 - o activation of electrically gated ion channels
 - o muscle contraction
 - o exocytosis
- The course of the action potential can be divided into five phases:
 - Stimulation
 - Rising phase (Depolarization)
 - Peak phase
 - Falling phase (Repolarization)
 - Undershoot (after hyperpolarization)

Q-17 Define Ultrafiltration.

Glomerular Filtration (Ultrafiltration)

- Glomerular filtration of plasma to form an ultrafiltrate is the first step in urine formation.
- It takes place in the renal corpuscle under pressure.
- The pressure comes from glomerular capillaries which have exceptionally high blood pressure than any other capillary bed in the body.
- Due to high filtration pressure, water and small solute molecules are filtered out of the glomerular capillaries.
- This filtrate is collected in the Bowman's capsule.
- Large molecules like proteins as well as blood cells and platelets are left behind in the blood.
- The filtered fluid in the Bowman's capsule is called glomerular filtrate.
- It has a chemical composition similar to that of blood plasma.

Q-18 Difference between Acclimation and Acclimatization.

Acclimatization: Acclimatization is a physiological, biochemical, or anatomic change within an individual animal that results from the animal's chronic exposure to new, naturally occurring environmental conditions.

Acclimation: Acclimation refers to the same process as acclimatization, but the changes are induced experimentally in the laboratory or field by the investigator.

Q-19 What is surface area of small intestine?

The intestinal folds, villi and microvilli collectively increase the surface area available for absorption more than 500 times. The total area for absorption in small intestine of human is 200-300 m² as compared to the small intestine's gross cylindrical area of 0.4 m².

Q-20 Write properties of hormones.

Hormones

Hormones are signaling molecules produced by endocrine glands which are transported by the circulatory system to distant target organs and regulate physiology and behavior of the animal.

Properties of Hormones

- Hormones act only on specific target cells/tissues
- Hormonal action depend on the type of receptor
- Hormones are active at very low concentration
- Hormonal effects are amplified

Q-21 Write a note on myogenic pacemaker.

In many invertebrate hearts, the pacemaker is neurogenic that consists of neurons. These hearts are known as neurogenic hearts. The pacemaker in some invertebrate and all vertebrate hearts is myogenic i.e. consists of specialized self-excitatory muscle cells. Such hearts are known as myogenic hearts. In vertebrates, the pacemaker is situated in the sinus venosus in those vertebrates which have it as a chamber of heart. In amniotes, it is located in a vestigial remnant of sinus venosus as the sinoatrial node (SA node), situated in the superior posterolateral wall of the right atrium.

Q-22 Define homeostasis with five examples.

During evolution, each species has assumed a specific set of internal environment with an ability to resist environmental changes by making adjustments to keep its internal fluctuations in a narrow range. This ability to protect internal environment from the harms of fluctuations in external environment is termed as homeostasis.

Homeostasis does not mean to keep a fixed internal environment as the changes maintained within a specific range are necessary for normal body functions.

Examples:

- Water availability may fluctuate tremendously in the external environment, from abundant supply to almost dry conditions.
- The quantity of water in the body i.e. internal environment may vary, but in a narrow range, in response to either abundant supply in dry condition.
- It means that the homeostatic control systems would not let the body flooded with water in abundant supply and also not let it to dehydrate in dry conditions.
- Homeostasis maintains the temperature of healthy human body near 37°C, inspite of environmental temperature variations.
- The pH of blood and interstitial fluid is maintained at 7.4 with a fluctuation range of only 0.1 pH unit.
- The concentration of glucose in the bloodstream is regulated near the range of 90 mg per 100 ml of blood even if one is fasting or full stomach.

Q-23 Define peristalsis and reverse peristalsis.

The continuous contractions and relaxations of the circular and longitudinal muscles that produce alternating waves of constriction and distension in the lumen of the alimentary canal are known as peristalsis. Peristalsis starts from the buccal cavity and continues along the esophagus to the stomach and then along the whole alimentary canal till the rectum.

Antiperistalsis involves a backward or retrograde movement of the muscles in the digestive tract, which can result in the contents of the stomach or intestines moving in the wrong direction. This can lead to symptoms such as vomiting, regurgitation, or the movement of stomach contents back into the esophagus. It's worth noting that antiperistalsis is not a normal or healthy physiological process and is often associated with conditions like gastrointestinal disorders, obstructions, or certain types of medical interventions.

Q-24 Write three characteristics of membrane potential.**Membrane potentials:**

All electrical phenomena in the cells and particularly neurons depend on transmembrane potential difference, generally called as membrane potential, V_m . This potential difference is electrochemical in nature. This potential difference is the basis of generation of signals which are used by neurons in communication and muscles in contraction. Membrane potential arises from two features found in all eukaryotic cells:

1. The concentrations of several ions inside the cell are different from their concentrations in the fluids outside the cell. These concentration gradients are maintained at the expense of metabolic energy.
2. The ion channels in the membrane are selectively permeable to different ionic species.

Q-25 What is Donnan effect?

Donnan equilibrium implies that if there is a non-diffusible solute in one of the solutions separated by semi-permeable membrane, the concentrations of solutions on both sides do not equalize. The concentration of the solution with nondiffusible solute remains high even at equilibrium. This is known as Donnan effect. The Donnan effect can be correlated to living cells which contain non-diffusible anionic colloids, made up of proteins and organic phosphates which cannot cross the cell membrane. As a result of this, there is a 22 high concentration of non-diffusible anions across the cell membrane, thus creating the Donnan Equilibrium. This means that there are more ions inside the cell than outside.

Q-26 Write role of ADH in absorption.

Antidiuretic hormone (ADH) facilitates water reabsorption in the kidneys. Released in response to low fluid levels or increased blood osmolarity, ADH binds to renal tubule cells, causing aquaporins—water-channel proteins—to be inserted into cell membranes. This enables more water to move from tubular fluid back into cells and then into the bloodstream. By concentrating urine and reducing fluid loss, ADH helps regulate water balance, essential for maintaining proper hydration and managing body osmolarity.

Q-27 Explain motility of cilia.

Ciliary motility involves beating of the cilia lining the digestive tract. Cilia generate fluid currents that propel food within the digestive tube. Ciliary motility is the only mechanism used to translocate food along the alimentary canals of annelids, many mollusks, tunicates, and cephalochordates. Muscular digestive tracts are lined by cilia in echinoderms and most mollusks. So, they use both mechanisms simultaneously.

Q-28 Define physiology and name the laws of physics and chemistry used in physiology.

Physiology

Animal Physiology deals with the study of functions of the tissues, organs and organ systems of animals. The ultimate goal of the study of physiology is to understand the mechanisms that operate in animals at all levels, in physical and chemical terms.

Physiological Mechanisms Obey Laws of Physics and Chemistry:

The knowledge of Physiology is firmly rooted in the laws and concepts of physics and chemistry. Following are the examples of some physical and chemical laws and concepts that relate to various physiological processes:

- Ohm's Law—applies to blood flow and pressure; ionic current; capacitance of membranes.
- Boyle's Law and the Ideal Gas Law—applies to respiration.
- Law of Gravity—applies to blood flow.
- Concepts of kinetic and potential energy—apply to muscle contraction; chest movements during inhalation and exhalation.
- Concepts of Inertia, momentum, velocity and drag—apply to animal locomotion.

Q-29 Explain single unit muscle.

Single-Unit Muscles

- Individual muscle cells are small, spindle shaped and mononucleate.
- They are coupled with one another through electrically conducting gap junctions.
- So, if only a few cells are excited and generate contraction, the entire muscle mass contracts as the wave of depolarization is passed from one cell to the other through gap junctions.
- Neurons synapse onto single-unit muscle cells and can modulate the rate and strength of contraction, but neuronal input is not required for contraction.
- Single-unit smooth muscle forms the walls of vertebrate visceral organs e.g., alimentary canal, urinary bladder, ureters, and uterus.

Q-30 Write factors of ultrafiltration.

Ultrafiltration is a critical process that occurs in the kidneys during the formation of urine. It involves the filtration of blood through the glomerular filtration barrier, which consists of the glomerular capillaries, the basement membrane, and the epithelial cells known as podocytes. Several factors contribute to the process of ultrafiltration:

1. **Blood Pressure:** The primary driving force behind ultrafiltration is the hydrostatic pressure exerted by the blood in the glomerular capillaries. This pressure forces water and small solutes through the filtration barrier and into the Bowman's capsule.

2. **Glomerular Capillary Permeability:** The walls of the glomerular capillaries are fenestrated (containing small pores) to allow small molecules like water, ions, glucose, and waste products to pass through while preventing the passage of larger molecules such as proteins and blood cells.
3. **Oncotic Pressure:** Also known as colloid osmotic pressure, this is the pressure exerted by the proteins (mostly albumin) in the blood. It opposes filtration by drawing water back into the capillaries due to the osmotic attraction between water molecules and dissolved proteins.
4. **Basement Membrane:** The basement membrane acts as a physical barrier that restricts the passage of larger molecules, like proteins and blood cells, while allowing smaller molecules and water to pass through.
5. **Podocyte Structure:** Podocytes are specialized cells that wrap around the glomerular capillaries and have foot-like extensions called pedicels. These pedicels create gaps known as filtration slits, which further regulate the size of molecules that can pass through.
6. **Surface Area:** The large surface area of the glomerular capillaries enhances the filtration process, allowing for a greater amount of fluid and solutes to be filtered.
7. **Net Filtration Pressure:** This is the difference between the hydrostatic pressure and the oncotic pressure across the glomerular capillaries. A positive net filtration pressure favors filtration, while a negative pressure opposes it.
8. **Renal Blood Flow:** The rate of blood flow through the kidneys affects the amount of filtrate produced. Higher renal blood flow leads to higher filtration rates.

Q-32 Write functions of Progesterone.

Maintains Endometrial Lining: Progesterone plays a crucial role in preparing and maintaining the endometrial lining of the uterus, which is essential for a successful pregnancy.

Supports Pregnancy: If fertilization occurs, progesterone helps support early pregnancy by promoting the growth of blood vessels in the endometrium and preventing contractions of the uterine muscles that could lead to miscarriage.

Inhibits Ovulation: Progesterone inhibits the release of additional eggs from the ovaries, preventing multiple ovulations during a single menstrual cycle.

Thickens Cervical Mucus: It thickens cervical mucus, creating a barrier that makes it more difficult for sperm to reach and fertilize an egg.

Regulates Menstrual Cycle: Progesterone, along with estrogen, helps regulate the menstrual cycle by influencing the development and shedding of the uterine lining.

Supports Breast Development: Progesterone plays a role in the development of mammary glands in the breasts in preparation for potential lactation during pregnancy.

Modulates Mood and Sleep: It can have effects on the central nervous system, influencing mood and sleep patterns. Progesterone has a calming effect and may contribute to improved sleep.

Regulates Body Temperature: Progesterone is involved in the regulation of body temperature, especially during the menstrual cycle.

Supports Bone Health: It may have a role in maintaining bone density, although estrogen plays a more significant role in this aspect.

Affects Metabolism: Progesterone can influence metabolism, including water retention and sodium balance.

Stimulates Maternal Instincts: During pregnancy, progesterone levels remain high and contribute to the development of maternal instincts.

Q-33 What are types of blood cells?

There are three main types of blood cells:

1. **Red Blood Cells (RBCs):** Responsible for carrying oxygen to tissues and organs.

White Blood Cells (WBCs): Part of the immune system, involved in fighting infections.

Platelets: Cell fragments that aid in blood clotting to prevent excessive bleeding.

Q-34 Write a note on Hemocyanin.

Hemocyanin is a respiratory pigment found in the blood of some invertebrates, like mollusks and arthropods. It contains copper and is responsible for transporting oxygen in these organisms. Hemocyanin turns blue when oxygenated and plays a vital role in their open circulatory systems, facilitating gas exchange directly with tissues.

Q-35 Explain neuropeptide.

Neuropeptides are short chains of amino acids that act as signaling molecules in the nervous system. They play a role in modulating neuronal communication, influencing various physiological processes such as pain perception, mood regulation, and appetite control. Neuropeptides are synthesized in neurons, released in response to specific signals, and bind to receptors on target cells to exert their effects.

Q-36 Write function of Prolactin in pigeon.

In pigeons, as in many other vertebrates, prolactin plays a crucial role in the reproductive physiology of females. Specifically, its functions in pigeons include:

1. **Stimulation of Crop Milk Production:** Prolactin is responsible for the development and secretion of crop milk in pigeons. Crop milk is a specialized secretion produced by the

lining of the crop (a pouch-like structure in the esophagus) in both male and female pigeons. It serves as the primary source of nutrition for the chicks during their early days.

2. Regulation of Parental Behavior: Prolactin is involved in the regulation of parental behaviors, particularly the expression of nurturing and caring behaviors by both male and female pigeons. It promotes the incubation of eggs and the feeding of chicks.

3. Maintenance of Reproductive Cycle: Prolactin levels rise during the breeding season, aligning with the increased demands of reproduction. It helps maintain the reproductive cycle by supporting the physiological changes associated with nesting, egg-laying, and chick-rearing.

4. Inhibition of Gonadal Activity: Prolactin may suppress gonadal activity during the nesting and chick-rearing period, redirecting the energy and resources of the parents towards caring for their offspring.

Q-37 Write a note on endoskeleton in human.

The endoskeleton in humans refers to the internal structural framework composed of bones and cartilage that provides support, protection, and facilitates movement. Here are key points about the human endoskeleton:

1. Bone Composition: The human endoskeleton is primarily composed of bones, which are rigid connective tissues made up of mineralized calcium phosphate crystals (hydroxyapatite) and collagen fibers. Bones give the skeleton its strength and resilience.

2. Cartilage: In addition to bones, cartilage is another essential component of the endoskeleton. Cartilage is a flexible and elastic connective tissue found at the ends of bones, in joints, and in various other structures like the nose and ears. It provides cushioning and facilitates smooth joint movements.

3. Support and Protection: The endoskeleton provides structural support for the body, maintaining its shape and preventing it from collapsing. Bones also protect vital organs such as the brain, heart, and lungs from external forces.

4. Facilitation of Movement: Muscles are attached to bones via tendons, and the contraction of muscles pulls on the bones, resulting in movement. Joints, where bones meet, allow for a wide range of motions, enabling activities such as walking, running, and grasping objects.

5. Hematopoiesis: Certain bones, particularly in the marrow cavities of long bones, are involved in hematopoiesis—the production of blood cells (red blood cells, white blood cells, and platelets).

6. Mineral Storage: Bones serve as a reservoir for minerals, especially calcium and phosphorus. These minerals can be released into the bloodstream when needed for various physiological functions.

7. Dynamic and Adaptable: The endoskeleton is dynamic and adaptable. Throughout life, bones undergo remodeling, a process involving bone resorption (breakdown) and bone formation, which helps in maintaining bone density and structure.

Q-38 Name kidney hormones.

1. Erythropoietin (EPO)
2. Renin

Q-39 What is trimodal breathing?

Trimodal breathing is a breathing pattern characterized by three distinct phases: abdominal or diaphragmatic breathing, thoracic or chest breathing, and clavicular or upper chest breathing. It involves the coordinated use of different respiratory muscles to optimize oxygen intake and carbon dioxide elimination.

Q-40 Write function of Prolactin in fishes.

In fishes, prolactin primarily functions to regulate ion and water balance, particularly in freshwater species. It helps maintain osmoregulation by influencing the uptake of ions (such as sodium and chloride) and water through the gills. Additionally, prolactin may play a role in reproductive behaviors and parental care in some fish species.